

What is claimed is:

1. A microactuator comprising:

2 a stationary element fixed on a substrate and
3 having a plurality of stationary element electrodes
4 arranged at a predetermined pitch;

5 a movable element having a plurality of
6 movable element electrodes opposing to said stationary
7 element electrodes, said movable element being moved by
8 applying a voltage across said stationary element and
9 said movable element; and

10 a first microstructure formed on at least one
11 of opposing surfaces of said movable element and said
12 stationary element to prevent said movable element from
13 attaching to said stationary element.

2. A microactuator according to claim 1, further
2 comprising an insulating film formed on at least one of
3 said opposing surfaces of said movable element and said
4 stationary element, and

5 wherein said first microstructure is formed on
6 said insulating film.

3. A microactuator according to claim 2, wherein
2 said first microstructure has a microstructural shape
3 formed on a surface of said insulating film.

4. A microactuator according to claim 1, further
2 comprising an insulating film formed on a surface
3 opposing said surface on which said first microstructure
4 is formed.

5. A microactuator according to claim 1, further
2 comprising a second microstructure formed on at least
3 one of opposing surfaces of said movable element and
4 said substrate to prevent said movable element from
5 attaching to said substrate.

6. A microactuator according to claim 5, further
2 comprising an insulating film formed on at least one of
3 said opposing surfaces of said movable element and said
4 substrate, and

5 wherein said second microstructure is formed
6 on said insulating film.

7. A microactuator according to claim 6, wherein
2 said second microstructure has a microstructural shape
3 formed on a surface of said insulating film.

8. A microactuator comprising:
2 a stationary element fixed on a substrate and
3 having a plurality of stationary element electrodes
4 formed in a comb tooth shape at a predetermined pitch;

5 a movable element having a plurality of
6 movable element electrodes separated from a surface of
7 said substrate, formed in a comb tooth shape, and
8 opposing to said stationary element electrodes, said
9 movable element being moved by applying a voltage across
10 said stationary element and said movable element;

11 a stopper arranged between said movable
12 element and said stationary element to prevent collision
13 of said movable element with said stationary element;
14 and

15 a microstructure formed on said stopper and at
16 least one of opposing surfaces of one of said movable
17 element and said stationary element which opposes said
18 stopper.

9. A microactuator according to claim 8, wherein
2 said stopper is formed to project from one of said
3 opposing surfaces of said movable element and said
4 stationary element, and

5 an interval between said stopper and one of
6 said movable element and said stationary element is set
7 smaller than an interval between said movable element
8 and said stationary element.

10. A microactuator according to claim 8, wherein
2 said stopper comprises:

3 a first engaging member formed on said movable
4 element and projecting toward said stationary element;
5 and

6 a second engaging member formed on said
7 substrate between said movable element and said
8 stationary element and arranged at a predetermined
9 interval from said first engaging member.

11. A microactuator according to claim 5, wherein
2 at least one of said first and second microstructures
3 has a hemispherical shape, and a top of said
4 hemispherical microstructure contacts said opposing
5 surface.

12. A microactuator according to claim 1, wherein
2 said movable element comprises a plurality of comb tooth
3 portions arranged at a predetermined pitch and each
4 having said movable element electrodes formed on one
5 side,

6 said stationary element comprises a plurality
7 of comb tooth portions alternately overlapping said comb
8 tooth portions and each having said stationary element
9 electrodes which are formed on one side and oppose said
10 movable element electrodes,

11 a distal end of each comb tooth portion of
12 said movable element opposes one side of said stationary
13 element, and

14 a distal end of each comb tooth portion of
15 said stationary element opposes one side of said movable
16 element.

13. A method of manufacturing a microactuator,
2 comprising the steps of:
3 forming a stationary element having a
4 stationary element electrode and a movable element
5 having a movable element electrode on a semiconductor
6 substrate, said movable element being formed to be
7 separated from a surface of said semiconductor
8 substrate; and
9 forming a microstructure on said movable
10 element and at least one of opposing surfaces of one of
11 said stationary element and said substrate.

14. A method according to claim 13, wherein the
2 step of forming said microstructure comprises the step
3 of forming a polysilicon thin film on said movable
4 element and at least one of said opposing surfaces of
5 one of said stationary element and said substrate to
6 form a microstructural shape on a surface of said
7 polysilicon thin film.

15. A method according to claim 13, wherein the
2 step of forming said microstructure comprises the step
3 of etching said movable element and at least one of said

- 4 opposing surfaces of one of said stationary element and
5 said substrate to form a microstructural shape.